REMARKS

Favorable reconsideration is respectfully requested in view of the foregoing amendments and the following remarks.

I. CLAIM STATUS AND AMENDMENTS

Claims 19-24 and 31-37 were pending in this application when last examined and stand rejected.

New claim 38 has been added. Support can be found in the disclosure, for example, at page 15, lines 13-20.

Claims 19-24 and 31-38 are pending upon entry of this amendment.

Applicants are submitting the present Amendment without prejudice to the subsequent prosecution of claims to some or all of the subject matter which might be disclaimed by virtue of this response (although none is believed to be), and explicitly reserve the right to pursue some or all of such subject matter, in Divisional or Continuation Applications.

Applicants thank the Examiner for the careful examination of this case and respectfully request reexamination and reconsideration of the case, as amended. Below Applicants address the rejections in the Office Action and explain why the rejections are not applicable to the pending claims as amended.

II. ENABLEMENT REJECTION

Claims 19-24 were rejected under 35 U.S.C. § 112, first paragraph, on the basis the specification fails to enable the full scope of the claims for the reasons set forth on pages 3-7 of the Office Action. Specifically, the Office argues that while the specification is enabled for a method involving certain specific branching enzymes, for example, *E. coli*, *C. reinhardtii*, or maize, it is not enabled for any and all possible starch branching enzymes whatsoever expressed in any genetically modified expression.

Applicants respectfully traverse this rejection.

The test of enablement is whether one reasonably skilled in the art could make or use the invention based on the disclosure in the specification coupled with the knowledge in the art without undue experimentation. The fact that experimentation may be complex does not necessarily make it undue, if the art typically engages in such experimentation. M.P.E.P., Eighth Ed., Rev. 6 (September 2007) at § 2164.01 and *In re Wands*, 858 F.2d 731, 737, 8 U.S.P.Q.2d 1400, 1404 (Fed. Cir. 1988). The test of enablement is not whether any experimentation is necessary, but whether, if experimentation is necessary, it is undue. In fact, the test is not merely quantitative, since a considerable amount of experimentation is permissible, if it is merely routine, or if the specification provides reasonable guidance with respect to the direction in which the experimentation should proceed.

In the instant case, it is respectfully submitted that the disclosure provides sufficient guidance to enable the full scope of the branching enzymes in the claimed method.

(1) Nature of the invention

On page 4 of the Action, the Office asserts that in order to use the claimed invention, one skilled in the art must possess the branching enzyme. In this regard, the rejection (based on In re Wands) seems to be drafted as though the present invention were directed to new enzymes with a new activity and to their process of preparation. However, this is not the case.

The present invention is directed to a novel process for making soluble branched polymers of glucose containing essentially no beta-glucosidic bonds. The main chain is kept and additional chains are laterally branched onto this main chain. There is therefore an increase of size and weight of the molecule. The process, which is a combination of features, involves subjecting an aqueous solution of starch or a starch derivative (of 1 to 50% by weight dry matter) to a temperature greater than 130°C, and a pressure of more than 3.5 bars, for 2 to 5 minutes. The resulting starch or starch derivative is treated with 50 to 2,000 units of purified branching enzyme at a temperature between 25 and 50°C for 10 minutes to 24 hours, and the branched polymers of glucose thus obtained are collected.

Thus, the nature of the invention actually is not what the rejection asserts. The claimed method is a novel process for

making soluble branched polymers of glucose containing essentially no beta-glucosidic bonds. To implement the novel claimed process, one skilled in the art uses a conventional branching enzyme such those of the EC 2.4.1.18 type.

(2) The state of the prior art

Applicants respectfully submit that the state of the prior art is not what the Office asserts.

As discussed above, Applicants respectfully submit that the branching enzyme is a conventional material and reagent, used in the process with HCl or water. The branching enzyme is readily obtainable as evidenced by the disclosure and the knowledge in the art. See for example: http://en.wikipedia.org/wiki/Glycogen branching_enzyme. At this location, it is disclosed that

> "Every 10 to 14 glucose units a side branch with an additional chain of glucose units occurs. The side chain attaches at carbon atom 6 of a glucose unit, and the linkage is termed an alpha-1,6 glycosidic bond, To form this connection a separate enzyme known as a branching enzyme is used. A branching enzyme attaches a string of seven glucose units to the sixth carbon of a glucose unit, usually in an interior location of the glycogen molecule.
>
> This enzyme belongs to the family of transferases, specifically those glycosyltransferases that transfer hexoses (hexosyltransferases). The systematic name of this enzyme class is 1,4-alpha-D-glucan:1,4-alpha-D-glucan 6-alpha-D(1,4-alpha-D-glucano)-transferase. Other names in common use include branching enzyme,....."

In addition, it is noted that the online-medical-dictionary defines the branching enzyme or 1,4-alpha-Glucan Branching Enzyme as follows:

> "In glycogen or amylopectin synthesis, the enzyme that catalyzes the transfer of a segment of a 1,4-alpha-glucan chain to a primaty hydroxy group in a similar glucan chain. EC 2.4.1.18."

The reference to EC 2.4.1.18 shows that the enzyme is well known by its effect and is a generic term, irrespective of its source.

What is important is the technical effect of the branching enzyme, *i.e.*, the side branching of additional chains of glucose units. Thus, Applicants submit that the process for preparing the branching enzyme and the original source of the branching enzyme have no major importance in the claimed method.

See the following websites as evidence that the branching enzyme is conventional, well known and readily obtainable in the art field:

http://www.chem.qmul.ac.uk/iubmb/enzyme/EC2/4/1/18.html or http://www.expasy.org/enzyme/2.4.1.18, for examples of details of the EC2.4.1.18 enzyme (official IUBMB Enzyme Nomenclature). Based on such, it is clear that the branching enzyme in the claimed process is well known and understood by those in the art field as being defined as:

Accepted name: 1,4-α-glucan branching enzyme.

Reaction: Transfers a segment of a (1→4)-alpha-D-glucan chain to a primary hydroxy group in a similar glucan chain.

Other name(s): branching enzyme; amylo-(1,4→1,6)-transglycosylase; Q-enzyme; alpha-glucan-branching glycosyltransferase; amylose isomerase; enzymatic branching factor; branching glycosyltransferase; enzyme Q; glucosan transglycosylase; glycogen branching enzyme; plant branching enzyme; alpha-1,4-glucan:α-1,4-glucan-6-glycosyltransferase; starch branching enzyme; 1,4-α-D-glucan:1,4-alpha-D-glucan 6-alpha-D-(1,4-alpha-D-glucano)-transferase.

Systematic name: (1→4)-alpha-D-glucan:(1→4)-alpha-D-glucan 6-alpha-D[(1→4)-α-D-glucano]-transferase.

Comments: Converts amylose into amylopectin. It is known that the accepted name can depend on the product, glycogen or amylopectin, e.g., glycogen branching enzyme, amylopectin branching enzyme. The latter has frequently been termed Q-enzyme. Links to other databases include BRENDA, EXPASY, KEGG, ERGO, PDB, CAS, and have the following registry number: 9001-97-2.

Accordingly, 1,4-α-glucan branching enzyme, branching enzyme, EC2.4.1.18 enzyme, etc are considered to be equivalent terms.

Thus, the branching enzyme is believed to be a conventional material/reagent used in the process like HCl or water. It has official nomenclatures: such as official IUBMB Enzyme Nomenclature: EC2.4.1.18 enzyme.

Applicants respectfully submit that the process for preparing the branching enzyme and the original source of the

branching enzyme are thus irrelevant in the instant case. Again, what is important is the technical effect of the branching enzyme, i.e., the side branching of additional chains of glucose units (EC2.4.1.18. effect).

In view of the above, it is respectfully submitted that one skilled in the art, upon reading the disclosure and in view of the knowledge in the art, could readily obtain and use any conventional and well known branching enzyme as encompassed by the generic claim term "branching enzyme" in the claimed method.

(3) The relative skill of those in the art

As acknowledged by the Office, the relative skill of those in the biotechnology industry is high.

(4) Predictability or unpredictability of the art

Applicants respectfully disagree with the Office's assertion (on page 5) that the process of obtaining every starch branching enzyme would be highly unpredictable.

Again, the present invention is not directed to discovering branching enzymes or new genes of such in new organisms. Accordingly, there is no need to obtain and try every starch branching enzyme. To implement the novel claimed process, one skilled in the art merely uses a conventional branching enzyme of the EC 2.4.1.18 type. Such branching enzymes are conventional and readily obtainable in the art field, and moreover, any one of which could be readily obtained and used in the claimed method without undue experimentation.

(5) The Breadth of the claims

The Office asserts that the claimed invention is very broad, encompassing all starch branching enzymes and that there is no particular limitation on the species from which the enzyme is extracted or its structural or physical properties.

Again, it should be noted that Applicants are not claiming new starch branching enzymes. Accordingly, there is no need to obtain and try every starch branching enzyme. Instead to implement the novel claimed process, one skilled in the art merely uses a conventional branching enzyme of the EC 2.4.1.18 type. What is important is the technical effect of the branching enzyme, *i.e.*, the side branching of additional chains of glucose units (EC2.4.1.18.effect). As such any EC2.4.1.18 type branching enzyme could be obtained and used in the instantly claimed process without undue experimentation.

(6) The amount of direction or guidance provided

Beginning at page 15, the specification provides in detail sufficient guidance as to techniques and procedures for obtaining the branching enzymes for use in the claimed process. For instance, at page 15, lines 13-20, the specification notes that the purified branching enzyme can be one selected from the group consisting of the branching enzyme of *E. coli*, the branching enzyme of *C. reinhardtt* and the branching enzyme of

maize. In this regard, see new independent claim 38 which corresponds such which is also the subject matter indicated as enabled by the Office.

Nonetheless, it is again noted that any branching enzyme EC2.4.1.18 may be used.

(7) The presence or absence of working examples

Here again, Applicants believe that the specification actually is not what the rejection asserts.

The Office alleges that the working examples provided use of one specific enzyme, obtained from *Chlamidomonas reinhardtii*. This is not correct.

The working examples (starting on page 17) exemplify the use of branching enzymes of very different sources. For instance, the specification demonstrates the use of branching enzymes, such as glycogen branching enzyme of *E. coli* (a bacterial enzyme) and a branching enzyme of the green alga *Chlamydomonas reinhardtii* (a plant enzyme).

Moreover, in contrast to the Office's position, it is respectfully submitted that the skilled artisan, could extrapolate from these examples how to obtain and use other branching enyzmes, such as those of the EC2.4.1.18 type in the instantly claimed process without undue experimentation. The examples in the disclosure should be sufficient since the branching enzymes have the same effect of transferring a segment

of a (1→4)-alpha-D-glucan chain to a primary hydroxy group in a similar glucan chain.

(8) The quantity of experimentation necessary

Again, it must be noted that what is important is the technical effect of the branching enzyme, i.e., the side branching of additional chains of glucose units (EC 2.4.1.18:effect). As such, any EC 2.4.1.18 enzyme maybe readily obtained and used in the claimed process. In fact, hundreds of references to EC2.4.1.18 enzymes can be found in the literature or on internet.

It is respectfully submitted that the skilled artisan, upon reading the disclosure and in view of the knowledge in the art, could readily obtain pure or purified EC 2.4.1.18 enzymes following standard techniques and procedures without undue experimentation.

Therefore, it is respectfully submitted that the skilled artisan, upon reading the disclosure and in view of the knowledge in the art, could readily obtain any of the conventional branching enzymes of the EC2.4.1.18 type encompassed by the claims and then use them in the claimed process. Moreover, it is submitted that such could be done using the routine techniques and procedures disclosed in the specification without undue experimentation.

In view of the above, Applicants respectfully submit that the specification provides full enabling support for the branching enzymes of the claimed method.

For this reason, the above enablement rejection is untenable and should be withdrawn.

Finally, it should be noted that the claims of OKADA (U.S. 4,454,161) (cited in the prior art rejection) are not limited to the use of a specific branching enzymes. In this regard, claim 1 of OKADA recites "subjecting the aqueous solution to the action of a branching enzyme (EC 2.4.1.18) for a period sufficient to form substantial branches in the amylaceous substance. . ." This is further evidence that branching enzyme and/or branching enzyme (EC 2.4.1.18) are equivalent and well recognized terms in the art field. In fact, since 1,4-α-glucan branching enzyme, branching enzyme, EC2.4.1.18 enzyme, etc. are considered to be equivalent terms for the reasons discussed above, Applicant would consider amending the current claims to reflect this nomenclature along the lines of a branching enzyme (EC2.4.1.18) or purified EC2.4.1.18 enzymes, if deemed necessary by the Office.

III. PRIOR ART REJECTIONS

A. Rejection over OKADA and SENKELESKI

Claims 19-22 were rejected under 35 U.S.C. § 103(a) as allegedly obvious over OKADA et al. (U.S. 4,454,161) in view of

SENKELESKI et al. (U.S. 5,562,937) for the reasons on page 7-9 of the Office Action. This rejection is respectfully traversed.

According to the Office, OKADA discloses a branched alpha-glucose polymer (starch) produced by the activity of a branching enzyme, for example an animal, plant, or microorganism branching enzyme in a starch such as amylopectin. A gelatinized solution of the starch is subjected to the action of the branching enzyme and then used, after concentration and/or drying, in food products. A bacillus branching enzyme is reported having an optimal temperature of about 25°C and being stable up to about 45°C. These starches display a reduced propensity for retrogradation.

OKADA does not disclose a method in which the starch is gelatinized by a treatment at over 130°C and 3.5 bars as recited in the instant claims. OKADA also does not explicitly disclose a method in which the amount of branching enzyme is between 50-2000 units and the reaction is carried out at exactly 30°C as in the claims. In this regard, OKADA does not render obvious treating a starch or starch derivative under the conditions recited in steps a) or b) of independent claim 19.

In step a), the recited starch or starch derivatives are subjected to a relatively high temperature and pressure for a relatively short duration. This stands in contrast to the conventional gelatinization conditions utilized by OKADA. Conventional gelatinization conditions use milder conditions than

those recited in step a) of claim 19. For example, to gelatinize waxy maize starch, the temperature is generally kept below 92° Celsius, the pressure is typically atmospheric, and the temperature is slowly raised to progressively reach the gelatinization temperature of the starch.

Although Example B-4 of OKADA utilizes a heating step of between 140°C to 145°C, the amylaceous substance (i.e., wheat flour) is heated in the presence of the branching enzyme to effect the gelatinization and enzymatic reactions simultaneously. In other words, Example B-4 enzymatically treats the amylaceous substance at a temperature almost three times greater than that recited in step (b) (i.e., between 25 and 50°C) of claim 19.

For these reasons, it is clear that OKADA fails to disclose or suggest each and every element of the claimed method. In fact, on page 8 of the Action, the Office even acknowledges that OKADA fails to disclose a method in which the starch is gelatinized by a treatment over 130°C and at a pressure of 3.5 bars are recited in step (a) of claim 19. The Office also acknowledges that OKADA fails to disclose or suggest the amount of branching enzyme (between 50-2000 units) and the reaction temperature of 30°C as in step (b) of claim 19.

The Office appears to rely on SENKELESKI as disclosing the temperature and pressure parameters and the amount of branching enzyme. Applicants respectfully submit that SENKELESKI fails to remedy the above-noted deficiencies of OKADA.

SENKELESKI discloses a method for digesting waxy starch with beta-amylase (column 1, lines 40-58). The starch, in order to be processed in this manner, is first steam cooked ala temperature of 120°C to 170°C at a pressure of about 4.1-5.5 bar. The Office states that:

> "[the gelatinized starch is enzymatically hydrolyzed] with beta-amylase or glucoamylase until up to about 60% by weight of the starch has been degraded to maltose or glucose" (Summary and claims 1 and 7)."
>
> "The enzyme reaction is continued until at least 5% and up to about 60% (preferably 15 to 35%,), by weight, of the starch has been degraded to maltose or glucose...
>
> "this exo-enzyme is capable of splitting the 1,4 linkages of the starch molecule but is not capable of splitting the 1,6 linkages, the residue of such degradation procedure is a compact molecular structure which is substantially free of outer branches or contains shortened outer branches. Alternatively, glucoamylase, an exo-enzyme which attacks the 1,4 linkages but also has limited activity with respect to the 1,6 linkages and results in the production of glucose andfragmented starch units may also be used.".

As such, in SENKELESKI, the main chain is cut into short pieces or even into glucose or maltose molecules. Consequently, there is therefore an important decrease of size and weight of the treated molecule.

Nonetheless, the Office states:

> "it would have been obvious to one of ordinary skill in the art at the time of the invention to use the gelatinization process of Senkeleski et al. to pregelatinize the starch, for example amylopectin, before the enzymatic step of Okada et al."

The Office further adds that:

> "one of ordinary skill in the art would have been motivated to use this gelatinization step because Okada et al. already teaches the use of a gelatinization step before the enzymatic digestion, and because the gelatinization of Senkeleski et al. is shown to be useful for gelatinizing starch in preparation for enzymatic digestion. One of ordinary skill in the art would reasonably have expected success because gelatinization procedures are routine and well known in the art, and choosing an appropriate procedure would be well within the ordinary and routine level of skill in the art."

Furthermore, the Office asserts:

> "it would have been obvious to one of ordinary skill in the art to optimize the amount of branching enzyme, and reaction temperature and duration to arrive at the values discussed in the instant claims. One of ordinary skill in the art would have been able to choose optimal values for these experimental parameters through a simple process of routine optimization, and would clearly have recognized reaction time, temperature, and amount of catalyst to be result-effective variables that could he varied to produce the desired result."

Applicants respectfully disagree. As explained above, the present invention is directed to a novel process for making soluble branched polymers of glucose containing essentially no beta-glucosidic bonds by using a branching enzyme. See above definition and hereunder for branching enzyme:

> "Every 10 to 14 glucose units a side branch with an additional chain of glucose units occurs. The side chain attaches at carbon atom 6 of a glucose unit, and the linkage is termed an alpha-1,6 glycosidic bond. To form this connection a separate enzyme known as a branching enzyme is used. A branching enzyme attaches a string of seven glucose units to the sixth carbon of

> a glucose unit, usually in an interior location of the glycogen molecule."

Thus, in the present invention, not only the main chain is kept but also additional chains are laterally branched onto this main chain. There is therefore an increase of size and weight of the molecule in the claimed process. This is exactly the opposite of what occurs in the process of SENKELESKI.

Further, it is well-settled that to support a rejection based on a combination of references, there must exist some motivation/rationale to make a change in the prior art teachings to establish *prima facia* case of obviousness.

Here, the cited prior art references provide no apparent reason for one ordinarily skilled in the art to modify and/or combine the teachings of OKADA and SENKELESKI to arrive at the claimed method. Moreover, one of ordinary skill in the art would certainly not have been motivated to use the pretreatment-gelatinization step of SENKELESKI, because this gelatinization is shown to be useful for gelatinizing starch with the view of splitting a macromolecule into small or very small pieces, which stands in contrast to the present invention. Again, this contrasts the claimed method in which there is an increase of size and weight of the treated molecule, by branching lateral chains onto the said treated molecule. See for example the attached drawing on, which can be found at: http://en.wikipedia.org/wiki/Glycogenbranehingenzyme.

In this sense, SENKELESKI could be said to "teach away" from the claimed method. It is well established that a prior art reference that "teaches away" from the claimed invention is a significant factor to be considered in determining obviousness. M.P.E.P., Eighth Ed., Rev. 6 (September 2007) at § 2145, X, D, 1. It is also well established that, if a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. M.P.E.P., Eighth Ed., Rev. 6 (September 2007) at § 2143.01, V.

Thus, it is submitted that there would have been no reason to combine and/or modify the teachings of SENKELESKI with those in OKADA to arrive at the claimed method.

For these reasons, it is believed that SENKELESKI fails to remedy the deficiencies of OKADA.

Thus, independent claim 19 is believed to be novel and nonobvious over the combination of SENKELESKI and OKADA. Claims 20-22 depend, either directly or indirectly on claim 19. Thus, these dependent claims are also novel and nonobvious over the combination of SENKELESKI and OKADA for the same reasons in view of their dependency on claim 19.

Thus, the above-noted 103(a) obviousness rejection over OKADA and SENKELESKI is untenable and should be withdrawn.

B. Rejection over OKADA, SENKELESKI and SANDSTROM

Claims 31-37 were rejected under 35 U.S.C. § 103(a) as allegedly obvious over OKADA in view of SENKELESKI and SANDSTROM et al. (PCT WO95/22562) for the reasons on pages 9-11 of the Office Action.

This rejection is respectfully traversed.

The above arguments with respect to OKADA and SENKELESKI are reiterated herein. As shown above, the Office's argument based on the combination of the teachings of OKADA and SENKELESKI is moot.

Further, as acknowledged at page 9 of the Office Action, OKADA and SENKELESKI do not disclose a composition containing the characteristics in instant claims 31-37. In this regard, it is worth while recalling that the present invention is directed to a novel process for making soluble branched polymers of glucose and to the resultant soluble branched polymers of glucose themselves (claims 31-37), wherein the resultant soluble branched polymers of glucose contain essentially no β-glucosidic bonds.

By contrast, the starches of SANDSTROM differ from the claimed invention in that they do possess β-glycosidic linkages. Accordingly, SANDSTROM fails to remedy to the deficiencies of the primary and secondary references of OKADA and SENKELESKI.

For these reasons, independent claim 31 is believed to be novel and nonobvious over the combination of OKADA, SENKELESKI

and SANDSTROM. Claims 32-37 depend, either directly or indirectly on claim 31. Thus, these dependent claims are also novel and nonobvious over the combined cited references for the same reasons in view of their dependency on claim 31.

Thus, the above-noted 103(a) obviousness rejection over OKADA, SENKELESKI and SANDSTROM is untenable and should be withdrawn.

IV. DOUBLE PATENTING REJECTION

Claims 19-22 were provisionally rejected on the ground of non-statutory obviousness-type double patenting over claims 1-4 of copending application No. 7015318 for the reasons on pages 12-13 of the Office Action.

On page 13 of the Action, it was indicated that "this is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented." Pursuant to US practice, it is respectfully requested the rejection be held in abeyance until the provisional status is removed and the rejection is formally made. Further, kindly clarify the status of the rejection as the Office appears to have cited an issued patent, although it references a "copending application."

V. CONCLUSION

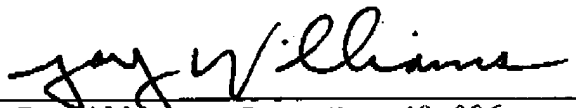
In view of the foregoing amendments and remarks, it is respectfully submitted that the present application is in condition for allowance and early notice to that effect is hereby requested.

If the Examiner has any comments or proposals for expediting prosecution, please contact the undersigned attorney at the telephone number below.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

YOUNG & THOMPSON



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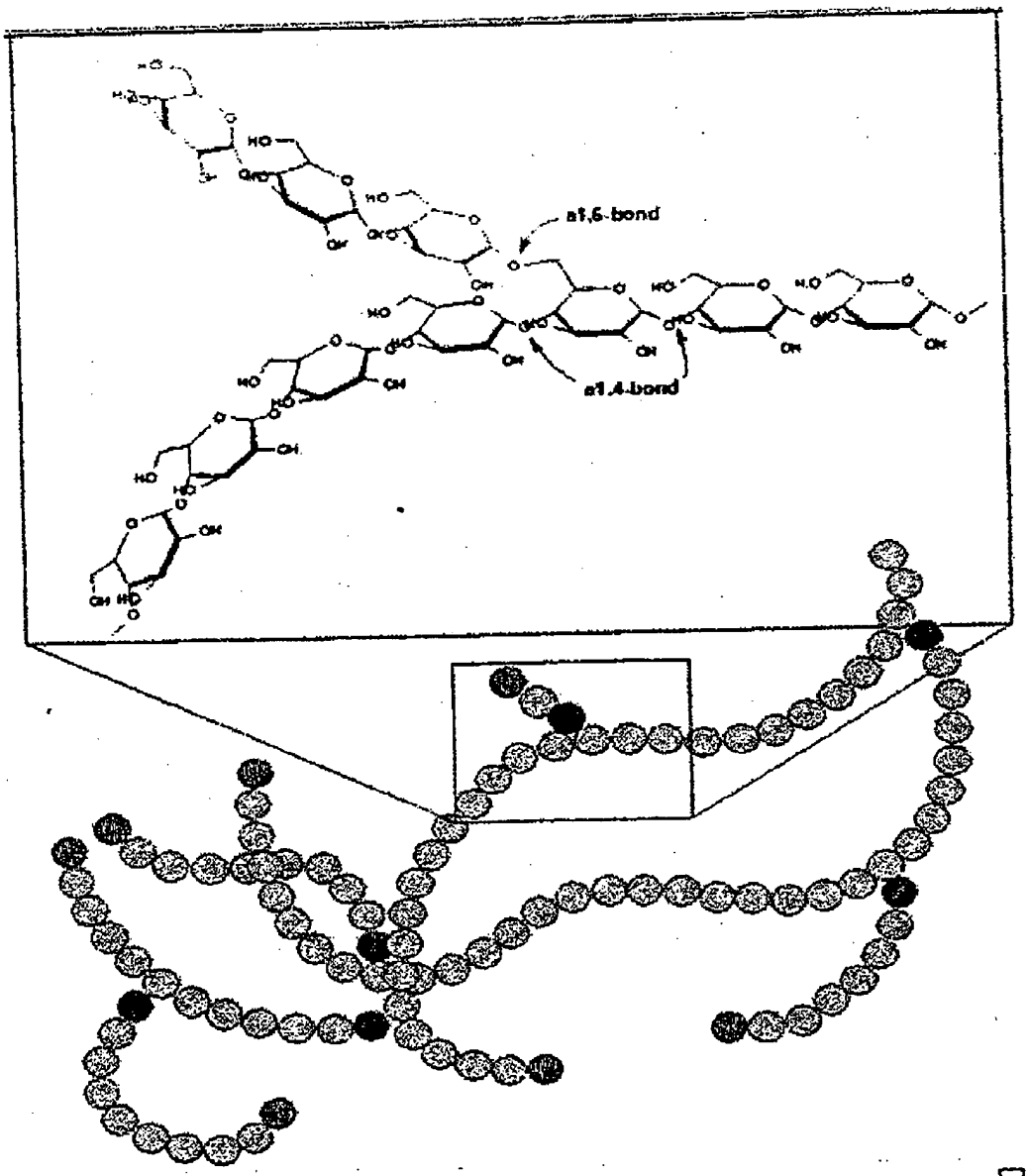
APPENDIX:

The Appendix includes the following item(s):

☒ - depiction of glycogen structure

APPENDIX 1



Glycogen structure